MEMORANDUM

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To: Sergio Ruiz, Caltrans

From: Hugh Louch, Beth Martin, Alta Planning + Design

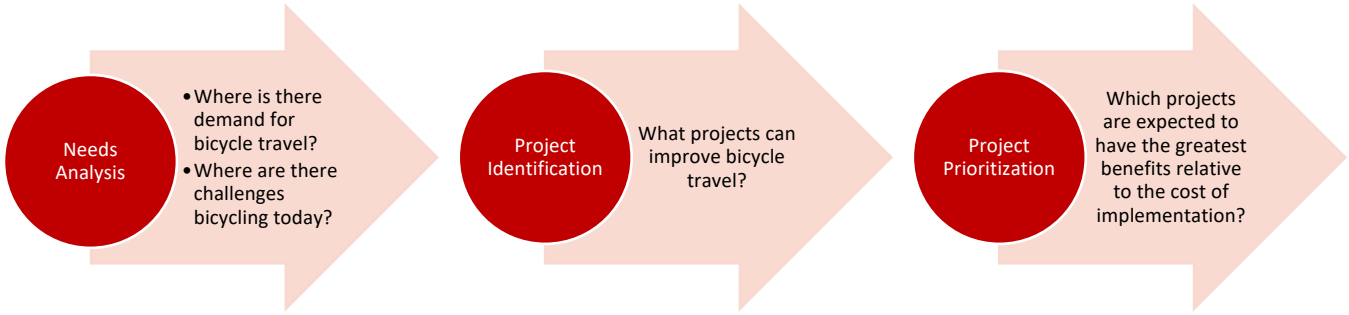
Date: December 8, 2017

Re: District 4 Bicycle Prioritization Methodology

Introduction

In Fall 2017, as part of the Caltrans District 4 Bicycle Plan, Alta conducted a Needs Analysis to identify where there is demand for and challenges to bicycling today on or across the state transportation system (see Figure 1). This memo outlines the methodology of the following two elements of analysis within the Plan: project identification and project prioritization. Following the development of the Needs Analysis, Alta identified what projects can improve bicycle travel on or across the state highway system in the nine county Bay Area. And most recently, Alta conducted a project prioritization in order to determine of the projects identified, which projects are expected to have the greatest benefits, given the project cost.

Figure 1. Elements of Analysis



Project Identification

Four types of projects were identified for inclusion in the District 4 Bicycle Plan, addressing both improvements along state highways and three types of crossings:

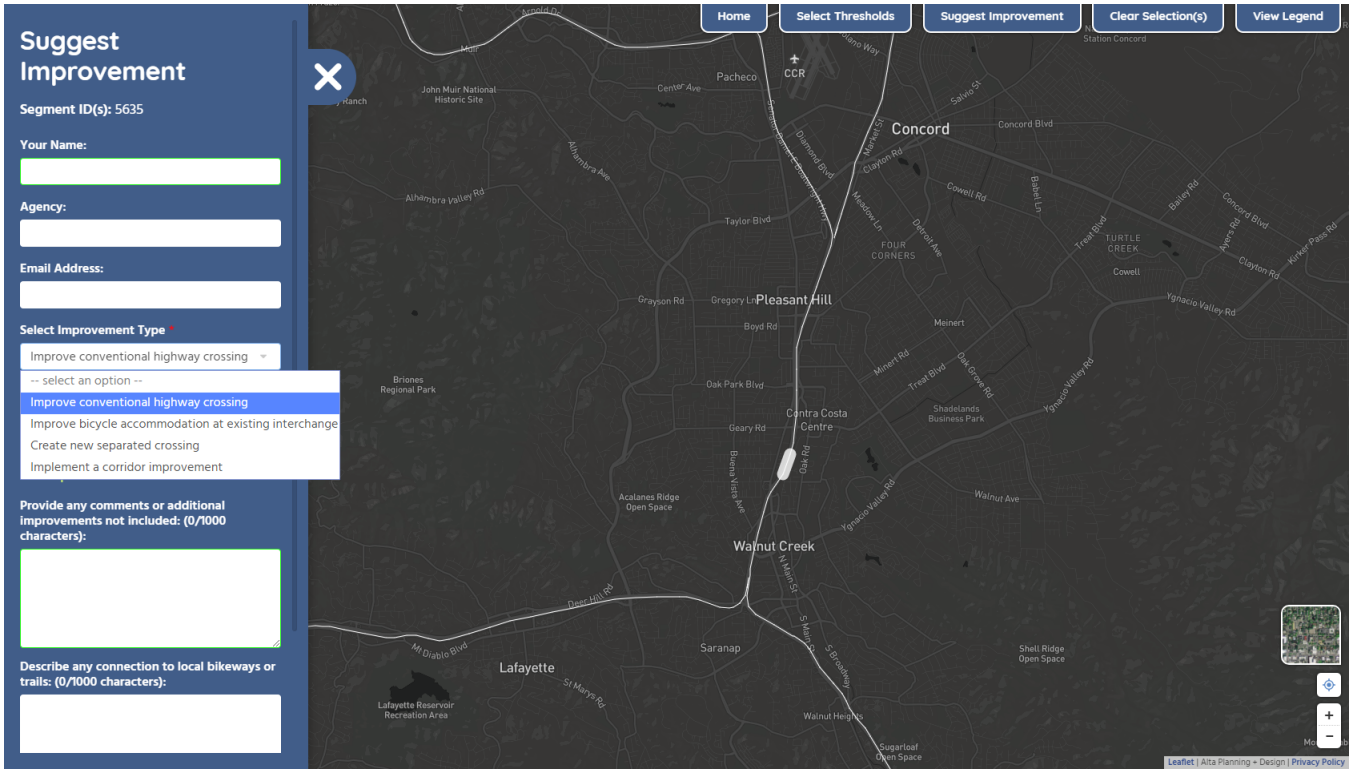
- **Corridor improvements – The addition of a roadway improvement or bicycle facility that improves bicycling for a segment of a state highway where bicycling is permitted. This can include shoulder improvements, a Class I shared use path, a Class II bike lane, a Class II buffered bike lane, or a Class IV separated bikeway.**
- **Interchange improvements – Improving bicycle accommodation at an existing interchange include minor improvements, such as new ramp merge treatments, or adding bike lanes and other supportive elements through the intersection. Major improvements include an interchange**

reconfiguration, either a partial reconstruction (ramps only) or a full reconstruction (replacement bridge to accommodate bikeway).

- Conventional highway crossings – Conventional highways interact with local streets (and other conventional highways) and include both controlled crossings (e.g., signals, stop signs) and uncontrolled intersections (where the traffic on the highway does not stop but is required to yield to pedestrians in a crosswalk). Potential projects for controlled intersections include intersection striping improvements, signal improvements (such as a bike signal or bike detection), or other advanced treatments (such as a bike box, two-stage turn box, or protected intersection). Improvements may also include changing intersection control (to stop, signal, pedestrian hybrid beacon or flashing beacon) or traffic calming methods (such as curb extensions, median refuge, and narrowing travel lanes).
- Separated crossings – Crossing a state highway may facilitate the need for a separated crossing, which includes overcrossings, undercrossings, and adding a bikeway under an elevated freeway.

Projects were gathered from existing City and County-level plans, identified by staff from local and county agencies and BPACs, and identified by the project team in locations where needs were identified. Alta developed a web input tool that allowed project team members and agency staff to identify the location and types of project improvements (see Figure 2).

Figure 2. Project Identification Web Tool



Project Prioritization

Following project identification, the project team prioritized projects based on several measures of potential benefit and the relative cost of the improvements. The prioritization process focused on projects that cannot be accomplished as part of regular maintenance or resurfacing projects.

Project prioritization considered six factors:

- **Demand – how many bicyclists are expected to use the facility?**
- **Existing Quality – what is the comfort and safety of the existing facility?**
- **Project Quality – how much an improvement is made by the new facility?**
- **Equity – does the project support a disadvantaged community?**
- **Local Priorities – is the project connected to a priority local project?**
- **Cost**

The first four of these factors were scored between 1 (high) and 4 (low). The scoring for the remaining two factors (local priorities and cost) is described within the detailed project scoring sections below.

The scoring methodology varies somewhat for corridor and crossing projects. Corridor project scores were calculated using the distribution of relevant data at the segment-level. Each project was defined for one or more quarter mile segments. Crossing projects used the best score for the affected segments. Most crossing projects included only one segment. Where a crossing fell at the junction of two segments or where the improvement could have been implemented in either segment, the projects were identified over two segments.

Demand

Projects were prioritized by the directly or indirectly measured demand for bicycling on the corridor or crossing. Demand was an important consideration because it provides a measure for the potential for people to bicycle along or across the state transportation system. Outlined in detail within the Needs Analysis memo, demand was measured using two factors. First, a weighted number of short distance trips (by any mode) using data from the Metropolitan Transportation Commission (MTC) travel demand model. Second, locations of current or desired bicycle travel from the public survey conducted for this Plan.

Table 1 - Demand Performance Measures

Data Source	Measure	Type*
Demand/System Use Measures		
MTC Model	Estimated short trips (high bicycling potential)	Indirect
Public Input	Locations of desired network use/crossing	Direct

Table 2 identifies the specific thresholds used to score both crossing and corridor projects considering these two data items.

Table 2 - Summary of Demand Performance Scoring

Score	Description	Crossing Scoring	Corridor Scoring
1	High demand *and* significant public support	• MTC Demand High (~ 1,000 or more short trips) *and* 48 or more survey points per mile, *or* • 96 survey points per mile	• 100% of corridor segments have MTC Demand High or Medium High (several hundred or more short trips) *and* 48 or more survey points per mile, *or* • 96 survey points per mile
2	Medium High demand *or* strong public support	• MTC Demand High or Med High (several hundred or more short trips) *or* • 16 or more survey points per mile	• 100% of corridor segments have MTC Demand High or Medium High (several hundred or more short trips), *or* • 48 survey points per mile
3	Medium demand *or* medium support	• MTC Demand Medium (~ 100 or more short trips) *or* • 12 or more survey points per mile	• One third of corridor segments have MTC Demand High or Medium High (several hundred or more short trips), *or* • More than 12 survey points per mile
4	Low demand *and* low support	• MTC Demand Low (fewer than 100 short trips) *and* • Fewer than 12 survey points per mile	• Some segments have MTC Demand above Low *or* • More than 0 survey points per mile
5	No demand	• Not scored for crossings	• 100 percent of segments have MTC Demand Low, *and* • 0 survey points per mile

Existing Quality

Identified projects were also scored based on the quality of the existing infrastructure, before any project is completed. The rationale behind examining existing quality is to prioritize projects where there are currently no comfortable bicycling facilities. For this measure, a 1 indicates the lowest existing quality (greatest need), and 4 indicates the highest existing quality (lowest need).

Existing quality was measured differently for crossing quality and corridor quality. For crossings, the measure considered the availability of high quality crossings in the vicinity of the proposed project (consider available crossings at quarter, half, and full mile increments). Level of traffic stress was measured for all existing state highway crossings as part of the needs analysis. This information was used to measure the number of available low stress crossings (LTS 1 or 2) available in the vicinity of the proposed project, as shown in Table 3.

Table 3 – Existing Crossing Quality Score

Score	Description	Number of High Quality Crossings (all conditions true)		
		¼ mile	½ mile	1 mile
1	No low stress crossings within a mile	0	0	0
2	No low stress crossings at the project location and a few in the vicinity	0	<2	<3
3	No more than one low stress crossing at the project location and no more than one per quarter mile	<2	<3	<5
4	No more than one low stress crossing at the project location, but several in the vicinity	<2	<4	<8
5*	Several existing low stress crossings	Any measure more than identified for a score of 4		

*** Generally, projects were not defined in areas with multiple existing low stress crossing opportunities.**

Corridor quality was measured considering the level of traffic stress of corridor segments and the number of bicycle collisions, weighted by severity. Again, both measures followed the methodology established in the Needs Analysis memo. Table 4 describes the thresholds used to establish existing corridor quality.

Table 4 – Existing Corridor Quality Score

Score	Level of Traffic Stress		Safety
1	90% of the corridor is LTS 3 or 4	*or*	• 90% of corridor segments had at least one sever injury or three visible injuries
2	60% of the corridor is LTS 3 or 4	*or*	• 60% of corridor segments had at least one sever injury or three visible injuries
3	30% of the corridor is LTS 3 or 4	*or*	• 30% of corridor segments had at least one sever injury or three visible injuries
4	More than 0% of the corridor is LTS 3 or 4	*or*	• More than 0% of corridor segments had at least one sever injury or three visible injuries
5	100% of the corridor is LTS 1 or 2	*or*	• 100% of corridor segments had at least one sever injury or three visible injuries

Project Quality

In contrast to existing quality, the project quality measures the amount of improvement for bicycling a proposed project would provide. For this measurement, a score of 1 indicates the highest project quality and 4 the lowest. Project quality was measured separately for different improvement types. Most scores also depend on the current condition of the facility – projects that create minor improvements on high stress facility do not score as highly as those that provide more significant improvements.

Corridor Improvements

Table 5 shows the scores used for corridor improvements, considering the class of the facility proposed and the existing level of traffic stress of the corridor.

Table 5 – Project Quality Score – Corridor Improvements

Facility Class	Existing LTS	
	1 or 2	3 or 4
I	1	1
II	3	4
II buffered	2	3
III/Shoulder Improvements	3	4
IV	1	1

Interchange Improvements

Interchange improvements include both major improvements, like reconstructing the interchange or its ramps to provide the, and minor improvements, like striping bicycle lanes, more clearly indicating conflicts, and similar improvements.

Table 6 provides the project quality scores for minor interchange improvements (no reconstruction of the ramps). Interchange improvements consider the class of the facility provided through the interchange, whether the ramps are signalized, and the improvements interact with the existing ramps. Three types of ramp configuration improvements are considered (Figure 1).

Major ramp reconfigurations are assumed to be quality 1, on the assumption that interchange or ramp reconstruction would lead to signalization or ramps and provision of bicycle facilities. Similarly, new separated crossings receive a quality score of 1.

Figure 1 – Bicycle Facility Interaction with Ramps

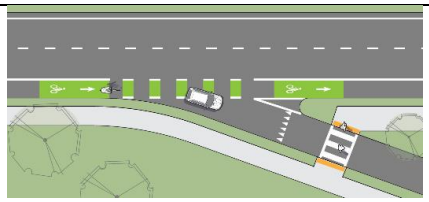
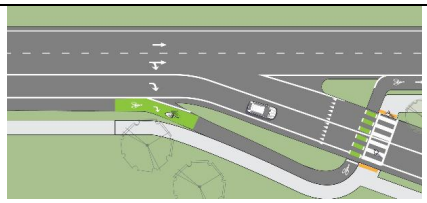
Example	Description
	**Auto Priority – crossing is striped, but bicyclists must yield to automobiles**
	**Bicycle Priority – crossing is striped and automobiles must yield to bicyclists**
	**Separated – bicyclists are provided a separate path of travel through the interchange area similar to pedestrians.**

Table 6 – Project Quality Scores – Minor Interchange Improvement

Facility	Auto priority	Bike priority	Separated
Add signals to ramps			
I, IV	1	1	1
II buffered	2	1	1
II	2	1	1
Striping Improvements only (ramps remain unsignalized)			
I, IV	2	1	1
II buffered	3	2	1
II	3	2	1

Conventional Highway Crossings

Table 7 and 8 present project quality scores for conventional highway crossings, for controlled and uncontrolled intersections respectively. Scores for these improvements were established based on the existing level of traffic stress and the type of improvement

Table 7 – Project Quality Scores – Controlled Conventional Highway Crossing

Relevant features	LTS 1, 2, or 3	LTS 4
Bike signal – separated bicycle signal phase and signal head	1	1
Auto turn restrictions on red or separate left turn phase for autos	1	2
Bike box and/or bike turn box	1	2
Lane continuation – marking lanes through intersection	3	4
Enhanced markings – green color markings	2	3
Protected intersection	1	1

Table 8 – Project Quality Scores – Uncontrolled Conventional Highway Crossing

Relevant features	LTS 1, 2, or 3	LTS 4
Add control – signal, pedestrian hybrid beacon, roundabout	1	1
Flashing beacon	1	2
Flashing beacon with bulb outs or median	1	2
Bulb outs or median alone	3	4

Equity

The prioritization methodology examines equity as a key measure, prioritizing projects that serve disadvantaged areas. For this analysis, a disadvantaged area includes areas identified as a Community of Concern, as defined by the Metropolitan Transportation Commission[1] and/or a disadvantaged community, as defined through CalEnviroScreen developed by the California Environmental Protection Agency[2]. Equity for this analysis is measured on a scale of 1 through 4, where 1 indicates that the project best serves disadvantaged areas and 4, where the project does not interact with a disadvantaged community. Table 9 outlines the equity scoring guidelines based on whether the project is a corridor or crossing project.

[1] https://mtc.ca.gov/our-work/invest-protect/investment-strategies-commitments/protect-our-climate/active-transportation
[2] https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-30

Table 9 – Equity Scores

	Corridor projects (% of project mileage in disadvantaged area)	Crossing projects (Closeness to disadvantaged area)
1	Over 2/3	Inside
2	Over 1/3	Within ½ mile
3	Adjacent/touches	Within 2 miles
4	Does not touch	More than 2 miles

Local Priorities

As part of the project development process, Caltrans and Alta staff met with county level planning agencies and, in some cases, bicycle advisory committees in the nine counties of the Bay Area. These meetings yielded information about local priorities that were used to supplement the measures described above.

In addition, the draft project list was circulated for public comment from November 27 to December 22, 2017 through an online web tool. The provided an opportunity to comment on specific projects and to 'like' or 'dislike' individual projects. A total of 2,312 likes and 66 dislikes were identified for projects, with likes ranging from 1 to 160. The projects with 25 or more likes are shown in Table 10.

Table 10 – Projects with Over 20 Likes

Project	Likes	Dislikes
West Span of Bay Bridge	160	2
Alameda Estuary Crossing	136	2
Hwy 1 Improvements (Class II/III) in Marin	60	3
City of Alameda Central Avenue Class IV/Class II	38	6
Marin Sonoma Narrows Trail along US 101	30	0
Vallejo Carquinez Bridge Trail connection	30	0
Class IV on San Pablo Ave	27	
Reconstruct Hwy 37 and add bikeway	27	3

These inputs were used along with the agency priorities to identify projects that may be considered local priorities. The use of local priorities is described in the Prioritization section below.

Cost

Cost was also considered in project prioritization. Few of the projects identified for inclusion in the Plan have specific cost estimates associated with them. Many projects are likely to implemented in coordination with local agency projects (e.g., adding bicycle facilities through an interchange as part of development of a bikeway on connecting local streets), making the specific cost somewhat challenging to ascertain. Table 11 identifies approximate qualitative rating of cost, following current Active Transportation Program categories.

Table 11 – Cost Ranges

	Description
$	Less than $250,000
$$	$250,000 – $1,500,000
$$$	$1,500,000 – $7,000,000
$$$$	Over $7,000,000

Prioritization Process

The purpose of the prioritization process is to sort projects into tiers of improvements. Prioritization considered performance (using the factors described above), cost, and likely implementation strategies. There are several means for Caltrans to implement the proposed projects, including:

- **State Highway Operation and Protection Program (SHOPP). Regular maintenance and preservation projects on state highways are typically funded through the SHOPP. This includes highway resurfacing, rehabilitation, structure maintenance, safety improvements, and similar projects. Per Caltrans policy, SHOPP projects are required to identify complete streets assets to be included in the project scope. This Plan will inform the identification of proposed complete streets assets. Many of the lowest cost bicycle plan projects can likely be implemented as part of a SHOPP project or potentially as individual low-cost striping projects.**
- **State Transportation Improvement Program (STIP). The STIP is a prioritized list of highway improvements. More significant improvements may be eligible for this program.**
- **Active Transportation Program (ATP). The Active Transportation Program is a grant funding source that combines a variety of federal and state funding sources for bicycle and pedestrian improvements by both Caltrans and local agencies. Caltrans can compete for these funds using the same process as local agencies or can partner with local agencies.**
- **Future Senate Bill 1 programs. Senate Bill 1 of 2017 increased the state gas tax and increased funding for ATP and a variety of other programs, such as the congested corridor program. These sources also present an opportunity to fund projects from this Plan.**

Considering these implementation paths, lower cost projects (under $250,000) were prioritized separately from higher cost projects.

Primarily Maintenance Projects

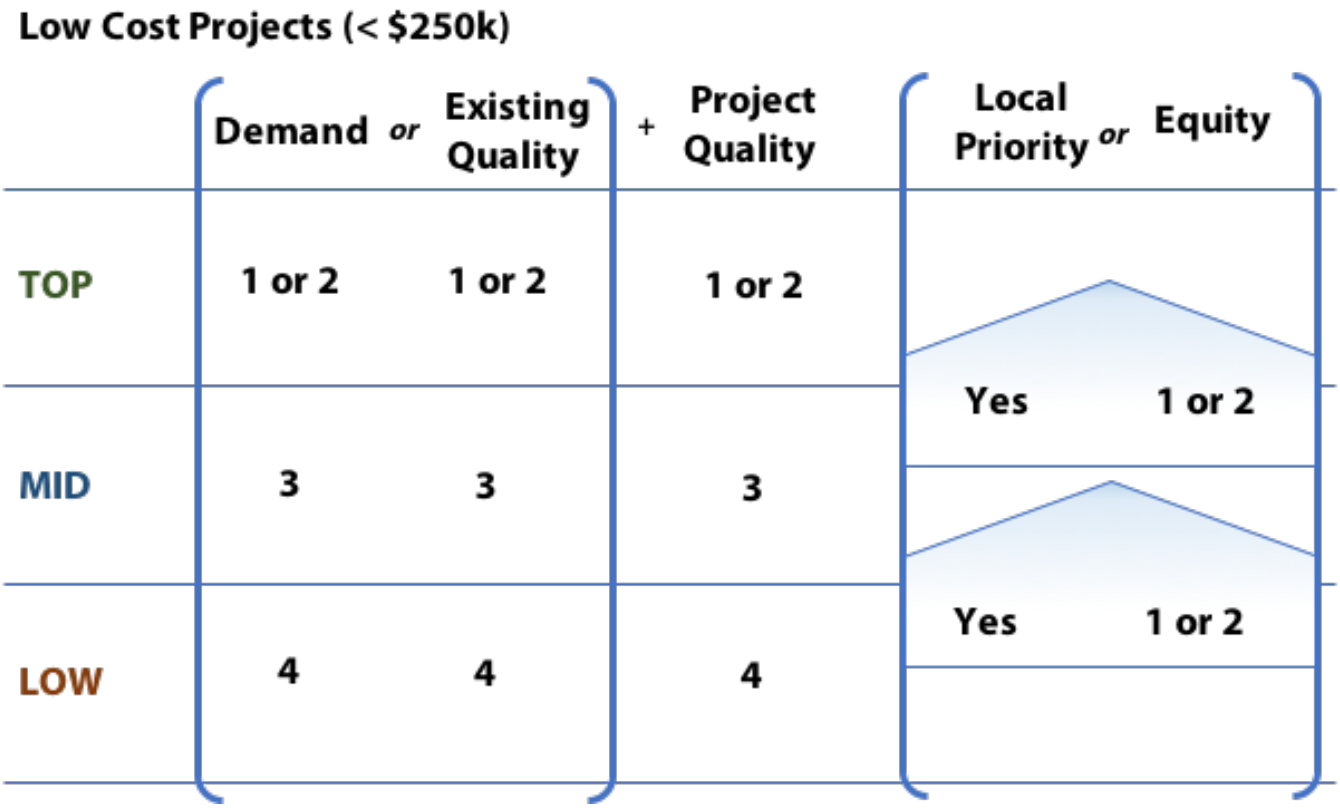
Lower cost projects are primarily achieved through the SHOPP. When SHOPP projects are considered, Caltrans policy requires identification of complete streets elements for inclusion in those projects. The list of projects identified for the bike plan includes several of these, though these types of improvements should also be included in SHOPP projects that may not have a project identified in this Plan.

For these types of projects, the Plan identifies priorities as follows:

- **Top tier projects have a demand score of 1 or 2 *or* an existing facility quality score of 1 or 2, but neither one with a score of 4, and a project quality score of 1 or 2.**
- **Mid tier projects have a demand score of 2 or 3 *or* an existing facility quality score of 2 or 3, and a project quality score greater than 4**
- **Low tier projects have demand or existing quality scores of 4.**
- **If a project is a local priority or has an equity score of 1 or 2, it moves up one tier.**

Figure 2 summarizes the approach.

Figure 2 – Low Cost Prioritization Process



Higher Cost Projects

Higher cost projects require a specific funding source for implementation and follow a slightly different prioritization process that focuses on the most important projects. For these types of projects, the Plan identifies priorities as follows:

- **Top tier projects have either a demand score or a facility quality score of 1 and the other score no lower than a 2 and a project quality score of 1 or 2.**
- **Mid tier projects have a combination of a demand score and a facility quality score that add up to no more than 4 (1 and 3, 2 and 2, 3 and 1) and a project quality score of 1 or 2.**
- **Low tier projects are all remaining project.**
- **Projects that are a local priority or have an equity score of 1 or 2 move up one tier, except for projects that scored no better than three on each of the demand score, facility quality score, and project quality score. (Note than fewer than 25 projects fell into this group.)**

Figure 3 summarizes the project prioritization process for higher cost projects.

Figure 3 – High Cost Project Prioritization

High Cost ($) Projects (Over $250,000)

	Demand	&	Existing Quality	&	Project Quality	Local Priority	*or*	Equity
TOP	1		1 or 2		1 or 2			
	1 or 2		1		1 or 2			
MID	1		2 or 3		1 or 2	Yes		1 or 2
	2		2		1 or 2			
	2 or 3		1		1 or 2	Yes		1 or 2
	1		1		3			
LOW	remaining projects							
VERY LOW	3 or 4		3 or 4		3 or 4			